HEALTHCARE RESOURCE UTILIZATION ASSOCIATED WITH ELEVATED POTASSIUM LEVELS IN PATIENTS WITH CHRONIC KIDNEY DISEASE

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Introduction

Hyperkalemia (HK), defined as elevated potassium (K+) levels >5.0 mmol/L is common in patients with chronic kidney disease (CKD), but population-based data on HK risk, prognosis and associated healthcare resource utilization (HRU) are scarce (Weisberg 2008; Kovesdy et.al.2015; Ingelfinger 2015).

Objectives

To understand the possible impact of new drug therapies for HK (Ingelfinger 2015, Packham 2015), we investigated the burden associated with HK among people with CKD in terms of incidence and healthcare resource utilization in a real-world setting.

Methods

- This cohort study conducted in Northern Denmark utilized routine care laboratory test results from both primary and hospital care for the entire region's population of 1.8 million residents (30% of Denmark's population) between 2000 and 2012 (Grann AF et al. 2011).
- Laboratory data were linked with hospital diagnoses and procedures data from the Danish National Patient Registry (NPR) which contains dates of admission and discharge, procedures (including emergency room and outpatient clinic visits), and primary and secondary diagnoses codes from all Danish hospitals (Schmidt M et al. 2015).
- We identified a cohort of newly diagnosed CKD patients (two eGFR measurements <60 mL/min/1.73m2 or a hospital-based diagnosis of CKD or hospital admission for a dialysis procedure) and followed them for first occurrence of HK in primary or hospital care
- HRU associated with HK was assessed based on individual level information on hospital care (in- and outpatient contacts), general practitioner consultations, and use of prescription drugs, and was compared 6 months before and 6 months after the HK event (self-controlled before-after analysis).
- Changes in HRU over time in the HK patients were also compared to matched CKD comparison patients without HK.
- CKD comparisons without HK were individually matched to CKD patients with HK on gender, age, time since CKD diagnosis, CKD stage (eGFR category), Charlson Comorbidity index (CCI) score category, presence of hyperkalemia-associated conditions (diabetes, congestive heart failure, or hypertension), and presence or absence of hyperkalemia-associated drug use (ACEis, ARBs, K+ sparing diuretics, or K+ supplements)

Results

- 157,766 patients with a first-time hospital diagnosis of CKD were identified, with a median age of 73 years and 59% females in the cohort.

Table 1. Demographics and underlying comorbidities in the CKD population with HK (Blood-K+ >5.0 mmol/L)

	CKD patients with HK[1]	Matched cohort without HK	Prevalence ratio (95% CI)
Total	43,397 (100%)	43,257 (100%)	-
Female	22,207 (51.2%)	22,150 (51.2%)	1.0 (1.0-1.0)
Median age (range)	76 (67.4-83.5)	76 (67.4-83.5)	-
Diabetes	11,019 (25.4%)	10,173 (23.5%)	1.1 (1.1-1.1)
Heart failure	8,574 (19.8%)	7,566 (17.5%)	1.1 (1.1-1.2)
Hypertension	30,650 (70.6%)	35,330 (81.7%)	0.9 (0.9-0.9)
ACEis	15,755 (36.3%)	15,873 (36.7%)	1.0 (1.0-1.0)
ARBs	7,817 (18.0%)	10,336 (23.9%)	0.8 (0.7-0.8)
K^+ sparing diuretics[2]	8,168 (18.8%)	5,605 (13.0%)	1.5 (1.4-1.5)
K^+ supplements	13,414 (30.9%)	13,596 (31.4%)	1.0 (1.0-1.0)
eGFR: 30-44[3,4]	14,471 (33.3%)	14,753 (34.1%)	1.0 (1.0-1.0)
eGFR: 15-29[4]	8,888 (20.5%)	8,572 (19.8%)	1.0 (1.0-1.1)
eGFR: <15[4]	2,606 (6.0%)	1,920 (4.4%)	1.4 (1.3-1.4)
Dialysis[3]	524 (1.2%)	290 (0.7%)	1.8 (1.6-2.1)

[1]K^+ >5.0 mmol/L; [2]spironolactone; [3]n=228 (1.7%) patients excluded due to no available eGFR value or presence of dialysis; [4]mL/min/1.73m^2

- During 615,890 patient-years of follow-up (median follow-up 2.9 years), 28% (n=43,397) of patients experienced a HK, i.e., a first blood test in primary care or hospital with K+ level >5.0 mmol/L, with a median of 1.2 years to event.
- 79.3% of the HK cohort had the first qualifying incident event with S-K+ levels of 5.0-5.5 mmol/L (13.6% in 5.5-6.0, 3.9% 6.0-6.5, 1.7% from 6.5-7.0, and 1.5% >7.0 mmol/L).
- Among 43,397 CKD patients with incident HK (median age 76 years), 0.9% were CKD stage 1-2, 37.6% stage 3A, 33.3% stage 3B, 20.5% stage 4, 6.0% stage 5 pre-dialysis and 1.2% were in dialysis (Table 1)

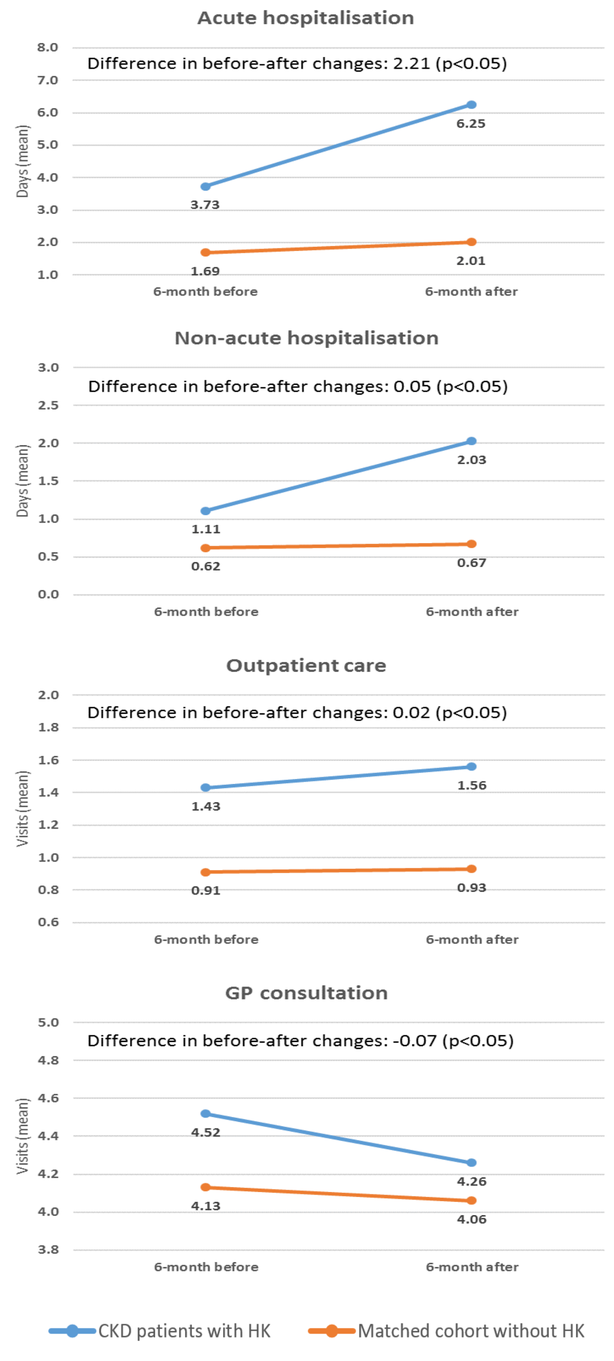
Table 2. Proportion with HRU in 6 month-period before and after the index HK event

	CKD patients with HK[1]			HR vs. matched cohort without HK
	6 months before	6 months after	RR[2] (95% CI)	HR[3]
Outpatient care/ER	24,724 (57.0%)	26,376 (60.8%)	1.16 (1.14-1.17)	1.37
Acute hospitalization	14,659 (33.8%)	24,773 (57.1%)	1.72 (1.69-1.74)	2.11
Non-acute hospitalization	7,233 (16.7%)	9,295 (21.4%)	1.49 (1.45-1.53)	1.62
Arrhythmia	402 (0.9%)	716 (1.6%)	2.05 (1.82-2.31)	2.29
Cardiac arrest	30 (0.1%)	284 (0.7%)	10.66 (7.34-15.50)	3.26
Dialysis	201 (0.5%)	657 (1.5%)	3.87 (3.32-4.52)	1.97
Ventilator	312 (0.7%)	2,737 (6.3%)	9.87 (8.79-11.08)	5.5
Hospitalization with ICU	916 (2.1%)	5,304 (12.2%)	6.45 (6.03-6.91)	4.77

[1]K^+ >5.0 mmol/L; [2]Self-controlled risk ratio adjusted for competing risk of death; [3]Hazard ratios for HK cohort versus matched non-HK cohort 6 months after the HK event/matched index date, adjusted for the prior-event hazard ratio.

- There were substantial HRU increases when comparing the 6 month-period after vs. 6 month before the index HK event, and HRU was greater than in the non-HK cohort (Table 2, Figure 1).
- The mean number of filled different drug prescriptions declined from 30 to 23 prescriptions (-24%), probably related to transfer to hospital care and mortality associated with the HK event.

Figure 1. HRU changes in 6 month-period before and after the index HK event



Conclusions

- ❑ Hyperkalemia is associated with poor clinical outcomes and a resulting increase in the utilization of healthcare resources, based on this Danish population cohort study.
- ❑ The risks of acute hospitalization, ICU admission and other components of healthcare resource utilisation are substantially increased after an event of HK in patients with CKD
- ❑ As the costs of hospital admission constitute the largest healthcare cost component, the economic burden associated with hyperkalemia for healthcare systems and societies is expected to be high.

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